REMARKS

Claims 1-8 have been cancelled and replaced with new claims 16-22. Non-elected claims 9-15 have also been cancelled and will be the subject of a divisional application. Reexamination and reconsideration of new claims 16-22 are respectfully requested.

Regarding the references in the International Search Report, Applicants submit herewith a PTO-1449 Form listing those references such that they may be listed on the face of any resulting patent.

In the Office Action, claim 1 was rejected as being anticipated by SHIRABE et al. (JP 62-225760 A). Also, claims 1-6 were rejected as obvious over LEIBER (US 4,785,848) in view of SUZUKI et al. (US 6,130,279). Claims 1-6 were also rejected as obvious over LEIBER in view of SUZUKI et al. (WO 98/16585). Further, claims 1 and 3-8 were rejected as obvious over YAMAKADO et al. (US 5,992,391) in view of SUZUKI et al. '279, as well as over YAMAKADO et al. (DE 19828672 A1) in view of SUZUKI et al. (WO '585).

In view of the new set of claims presented and the following remarks, Applicants respectfully traverse these rejections.

Applicants' new independent claim 16 recites a fuel injector having a valve driven by electromagnetic force. The fuel injector comprises a first coil in which a large excitation current flows for a short time during a beginning of a valve opening operation so as to secure magnetomotive force necessary to open said valve. A second coil is provided in which a relatively small excitation current flows so as to substantially secure magnetomotive force to hold the valve in an

open state after the valve is opened. These coils are wound on a bobbin formed by a resin molding material having a heat conductivity between 1.0 - 3.0 W/mk.

As claimed, the present invention is characterized by a bobbin formed of a resin molding material having a heat conductivity between 1.0 - 3.0 W/mk, in an injector which injects fuel directly into a cylinder of an internal combustion engine. In essence, the first coil is for securing magnetomotive force necessary to open the valve, and the second coil is for securing magnetomotive force to hold the valve in its open state.

Because a direct injection-type injector is used under extreme high temperature conditions such as in an internal combustion engine, Applicants' novel injector with its bobbin resin molding material is advantageous in such severe conditions.

By contrast, SHIRABE et al. merely discloses an electromagnetic fuel injection valve wherein the bobbin (2a) is made of a synthetic nylon resin containing a metal filler with high heat conductivity. However, because SHIRABE's et al. injector is not used as a direct injection type injector, it uses only a single type of coil, i.e., it does not use a first coil like the present invention. Because SHIRABE's coil is not used in the severe circumstances of a direct fuel injection system, its heat conductivity is approximately 0.5 - 0.7 kcal/mhr, which is low in comparison with that of the claimed invention.

Regarding the secondary SUZUKI et al. reference, while polyphenylene sulfide (PPS) and glass fiber resin having 55% - 85% alumina filler to produce a resin molding material with a heat conductivity of at least 1.5 W/mk is disclosed, SUZUKI does not at all describe or suggest a coil bobbin for a direct injection

type of fuel injector, let alone one having two coils. Nor does SUZUKI teach or suggest that such a coil bobbin is required for having a heat conductivity of at least 1.5 W/mk. Rather, prior art injectors used for automotive applications have only disclosed a heat conductivity of the bobbin between 0.5 - 0.7 W/mk, such as SHIRABE et al.

In view of the above, one skilled in the art obtains no suggestion or motivation to combine the teachings of SUZUKI with those of the other prior art references, such as SHIRABE et al., LEIBER, and YAMAKADO et al.

Indeed, the present inventor's devoted tremendous effort to the examination and study of both the heat-resistance and heat-conductivity required for direct injection bobbins for a two-coil type of injector. The advantageously claimed design provides a practical injector advantageous over the prior art. Accordingly, Applicants submit newly added claim 16 is patentable over the prior art of record.

Further, new dependent claim 22 recites a flange (for example 15a) located between the first and second coils. Since the flange functions as a radiator of the coils, it is especially advantageous for use in a direct injection-type of fuel injector. The use of such flange is nowhere taught or suggested in the prior art of record. Accordingly, Applicants submit new claim 22 is patentable over the prior art of record.

In view of the foregoing, Applicants submit claims 16-22 are now in condition for allowance. An early notice to that effect is solicited.

Summarizing, Applicants have made an important contribution to the art to which the present subject matter pertains, for which no counterpart is shown

in any of the art or combination of same. The invention is fully set forth and carefully delimited in all claims in this case. Under the patent statute, Applicants should not be deprived of the protection to which they are entitled for this contribution. Accordingly, it is respectfully requested that favorable reconsideration and an early notice of allowance be provided for all remaining claims.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #381NT/49740).

Respectfully submitted,

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Jeffrey D. Sanok
Registration No. 32,169

CROWELL & MORING, LLP
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844

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